19

THE CUNNINGHAM PAINT BOOK

THE MARYLAND STEEL COMPANY,
SPARROW'S POINT, MD.

TD CAT 1912 Maryland Steel Co.
ATHENAEUM OF PHILADELPHIA

Perhaps some time in the past you have daubed up something with common coal tar, and if you did not ruin it, you probably made a sticky, unsightly mess that you have not forgotten. Do not let that experience prejudice you against reading the following pages. You will not only learn how coal tar has been scientifically made into one of the best of paints, but you will also find much valuable information about paint in general.

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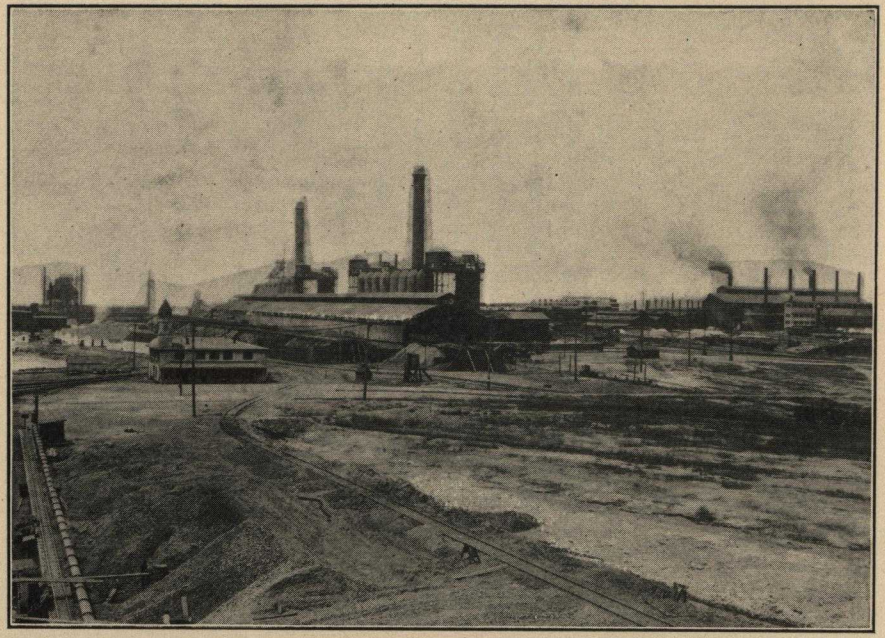

WORKS OF THE MARYLAND STEEL COMPANY.

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PAINT

THE CUNNINGHAM PAINT BOOK.

A concise treatise and reference book for paint users, containing practical information on the composition, properties, and uses of paint in general, and of Cunningham Protective Paint in particular; together with valuable formulas and useful data, much of which is hitherto unpublished.

THE MARYLAND STEEL COMPANY,
SPARROW'S POINT, MD.,
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THE STORY OF LINSEED OIL PAINT.

PAINT has two objects, ornamentation and protection, which are not always compatible. In either case it is important that it should be durable, according to accepted standards. The paints used on the ships of the United States Navy may be cited as examples of the highest type of excellence and efficiency in such materials. Such paints must be of the highest character and quality to stand the service to which they are subjected. They are exposed to great variations of temperature, all kinds of weather, and particularly to salt air and spray. The following are some of the standard Government formulas:

WHITE PAINT FOR OUTSIDE WORK ONLY.

FORMULAS No. 3 AND No. 4.

Formula No. 3, for mixing one gallon.

White Lead in Oil	Pounds	7
White Zinc in Oil	Pounds	7
Raw Linseed Oil	Gills	16
Turpentine	Gills	2
Japan Drier	Gills	1

FORMULA No. 4

For mixing one gallon.

White Lead in Oil	Pounds	5
White Zinc in Oil	Pounds	9
Raw Linseed Oil	Gills	12
Turpentine	Gills	4
Japan Drier	Gills	1

If two coats of paint are necessary, formula No. 3 will be used first, and formula No. 4 second. In repainting, or if a single coat will be sufficient, formula No. 4 will be used.

WHITE PAINT FOR INSIDE WORK ONLY.

FORMULA No. 9

For mixing one gallon.

White Lead in Oil	Pounds	7
White Zinc in Oil	Pounds	7
Raw Linseed Oil	Gills	8
Turpentine	Gills	8
Japan Drier	Gills	1

Ultramarine blue, enough to remove the yellow cast.

LEAD COLOR, OUTSIDE OR INSIDE.

(This is not the battleship color.)

FORMULA No. 24

For mixing one gallon.

White Lead in Oil	Pounds	19
Drop Black	Pounds	1
Raw Linseed Oil	Gills	9
Turpentine	Gills	8
Japan Drier	Gills	1

BLACK PAINT, OUTSIDE OR INSIDE.

FORMULA No. 31

For mixing one gallon.

Lampblack in Oil	Pounds	5
Raw Linseed Oil	Gills	12
Turpentine	Gills	2
Japan Drier	Gills	2

A study of these formulas and their ingredients will impart much information on the subject of paints and painting, and reveal many facts not generally known.

Linseed Oil is immediately noticed as a prominent and continuous ingredient in all these formulas. This oil is made from flax seed; originally the seed was ground or crushed and the oil pressed out of it while cold. The oil then stood in tanks for a long time until it settled and became clear. This was "Cold pressed linseed oil;" it has passed into history along with "Cold blast charcoal pig iron." By modern methods the flaxseed is treated hot and clarified by chemical and mechanical processes. A greater percentage of oil is obtained in a much shorter time. There is no objection to this modern linseed oil; it is quite as good for the majority of uses as the original.

The Peculiar Property of linseed oil that fits it for a paint oil is its manner of drying. It oxidizes slowly by atmospheric action from the surface inward, forming at first, a tough elastic skin on its own surface. The surface in time becomes completely oxidized to a dry powder, and the tough skin progresses inward towards the surface on which the paint is applied.

Linseed Oil Alone is not a durable protector as the large surface of oil exposed to atmospheric action permits rapid oxidation and early failure.

Substitutes: The history of commercial paint manufacture is a struggle to keep the quality

up to the original standards, and the price down to a point where paint can be used economically for protection, ornamentation, or both.

The price of linseed oil has been steadily advancing for some years and under these conditions, diligent search has been made for a substitute. Some years ago a modified fish oil was tried, but has disappeared. Attempts have been made to use cotton seed oil, but with poor success.

It is safe to say that so far no satisfactory substitute has been found for linseed oil. If such a substitute could be found, it would seem that there should have been some indications of it long ago.

Dilutions. While no substitute has been found for linseed oil, many of the oils that have been tried are used as dilutions in cheaper grades of oil. Their general effect on paint is bad. They do not show unfavorable results at once, but when the failure of the paint begins it is rapid. The dilutions permeating the linseed oil oxidize rapidly and expose large surfaces of the linseed oil itself to direct atmospheric action.

Boiled Oil was once more commonly used in making paint than it is now. Raw linseed oil was boiled in a kettle until it was considerably reduced in volume. The heat and ebullition of boiling produced a pre-oxidation which favored quick

drying. A later method of making boiled oil was by adding litharge or oxide of lead to raw linseed oil. There was no loss of volume and the quick drying effect was secured. One objection to this oil that was "boiled through the bung hole" was that the results were not definite and uniform.

A Body or Pigment is an essential component of a linseed oil paint for producing durability. In itself the pigment has no protective value, but it acts as a shield to the linseed oil.

The microscopic particles of pigment cover the outer surface of the oil and retard atmospheric oxidation except around their edges. In time the air will eat in under the particles of pigment and it will come off, but other layers of pigment are then encountered and final complete oxidation of the linseed oil is delayed in proportion to the value of the pigment as a shield.

White Lead is one of the oldest and most valuable of pigments for linseed oil paints with the exception of some forms of carbon. It is very opaque and has great hiding power to the surface on which applied. It is entirely neutral and has no chemical action on the oil or the surface of contact. White lead may be an oxide or a carbonate. One of the oldest forms is a carbonate produced by the "Dutch process," or the action of acetic acid on pure lead.

White Zinc is a valuable pigment when used in connection with white lead. One of the valuable properties is its greater stability against chemical action than white lead, which enables it to hold its white color where lead will become dark. When used as a pigment alone on outside work its durability is not good, and rapid "chalking" is likely to take place. White lead and white zinc mixed together in linseed oil make a more durable paint than either alone. The reason is that the microscopic particles of white zinc are smaller than in the case of white lead. The zinc thus fills up the spaces that would occur in the lead and in so doing greatly increases the surface of contact of the oil with the particles and at the same time leaves less surface of the oil to be directly acted upon by the air. A more complete shield is formed and the air has to work over an increased space before the oil is completely oxidized. The condition may be compared to the varying sizes of gravel and sand in concrete.

Successful mixtures of white lead and white zinc vary from three parts of lead to one of zinc at one extreme, and from one part of lead to three parts of zinc at the other extreme. With the zinc in excess the whitest paint results. A very durable mixture is two parts of lead to one part of zinc.

Adulterants: White lead and white zinc are also becoming more and more expensive, and substitutes for them have been sought for producing a white color for paint. Some of the substitutes tried are the following: Barites, calcium carbonate, china clay and silica.

In commercial paints these substitutes have never been used to entirely replace white lead, but have been used to largely dilute it. Their excessive use has given some of them a worse name than they deserve. Used in small proportions some of them have an action like white zinc and make a white lead paint more durable. None of them are as good as white lead and white zinc and most of them are much inferior.

Lithopone is a white pigment used as a substitute for white lead and zinc, and is composed of barium sulphate and zinc sulphate. It is being extensively experimented with and has given fair results on inside work. So far it has proved to be photometric on outside work and darkens from the effect of the sun. When sold as a paint it generally appears under some fanciful name, leaving the purchaser to assume that it may be a lead and oil paint.

Colored Paints. In general a colored paint is a lead and oil paint with a pigment added to

produce the color desired; such as vermilion, prussian blue, lampblack, and other standard colors. The important matter is that the coloring pigment should be neutral to the oil and to the surface to be painted.

Carbon Paints: In carbon paints the white lead or white zinc is replaced by some form of carbon, such as lamp black, pulverized charcoal, or some forms of graphite. They are generally quite black, but in the case of graphite may have a greenish cast. Some of the most durable linseed oil paints ever made have been with lamp black. Old signs may frequently be found on which the white lead background has entirely gone and the wood base has begun to weather, leaving the black letters in good condition and standing in relief above the surface. This is easily accounted for: the particles of lamp black are extremely small and form an almost perfect shield to the oil, and are not affected by the atmosphere. In addition the oil was the old original cold pressed kind.

Iron Ore is used as a substitute for white lead where the color is not of importance. There may be great variation in its shielding effect to the oil. The best ore for paint is supposed to come from Spain.

The Most Durable linseed oil paint would be a mixture of pigment with raw linseed oil alone, but it sets so slowly as to be impractical for most cases. Such a paint would slowly harden and form a tough skin on its surface, after which the oxidation would be slow with resulting long life.

Turpentine: The best mixtures of lead and oil paint are the result of many years of practical experience and observation. Such experiments and tests as are now being extensively made are not to improve the standard mixtures but to find good or suitable substitutes. With the steadily advancing and already high price of the best lead and oil paints, it is evident that durable substitutes are desirable for many purposes. The proportions of lead or of lead and zinc, with oil, that produce the most durable paints are too thick for ordinary use. Experience and observation have shown that turpentine is the best and least harmful thinning material that can be used in oil paint.

An excess of turpentine is harmful in making paint so thin that after the evaporation of the turpentine there is not sufficient thickness of the paint skin left to long withstand the oxidizing effect of the air. There is no equivalent substitute for turpentine in lead and oil paint. A dishonest painter will sometimes thin a good paint with

kerosene oil, naphtha or gasoline to make it spread easier and go further and the resulting coat is not only too thin but the paint is also injured by these materials.

Japan or Japan Drier is added to lead and oil paint to produce a "set" in a reasonable time. Its setting properties come from the litharge or oxide of lead it contains. It gives up the oxygen to the linseed oil and produces an internal oxidation or hardening in advance of what would be expected under atmospheric conditions. The painter will say that too much drier burns the paint and this is literally true. However, as we can seldom wait for days for a paint to set, much less to reasonably dry, the Japan drier is truly a necessary evil.

The Formulas: We may now make some general comparisons between the formulas, the first three being sufficient to illustrate the important principles. Formula No. 3, for first coat, is more liquid than formula No. 4. It contains more linseed oil than No. 4, and this linseed oil is the true life of the paint. The oil of the first coat will be protected from oxidation by the second coat. Formula No. 4 is somewhat whiter and more durably white than No. 3 on account of the excess of zinc. It is a more rapidly drying paint than No. 3

on account of the excess of turpentine, which soon evaporates, leaving a greater proportion of the Japan drier to linseed oil. Formula No. 4 is the ornamental coat and the temporary protector of formula No. 3.

Formula No. 9, for inside work, varies materially from the two preceeding. The proportions of lead and zinc are for durability. Turpentine is in excess as compared with the other two formulas, first to produce the necessary thinness and second to give a greater proportion of Japan drier to the linseed oil to secure quick drying properties. This paint being for inside work the subsequent oxidation will not be as rapid as where the sun and wind have full effect.

"Between The Devil And The Deep Sea," is probably where the reader who has not given much study to the details of paint, will think he has arrived by this time. The plain unvarnished truth is apt to land us all there sometimes, but it is a gain to know where one really is.

There is Plenty of Good Paint on the market, and a good start in judging a lead and oil paint is by the actual price. Some people will not consider any paint that costs less than a dollar and a quarter a gallon. When a paint is presented that costs at least as much per gallon as pure raw

linseed oil, the preceding general remarks will afford questions which will bring out everything that can stand telling.

As an Assistance in judging of the quality of a linseed oil paint from its price, the current market price of the materials entering into one of the foregoing formulas, at the time of this writing, will be of interest.

White Lead in Oil	Pounds	7	@ $ .0686		$ .48
White Zinc in Oil	Pounds	7	@ .11	-	.77
Raw Linseed Oil	Gallons	½	@ .92	-	.46
Turpentine	Gills	2	@ .65	-	.04
Japan Drier	Gills	1	@ 1.18	-	.04
					$1.79

This cost of course, does not include manufacture or package.

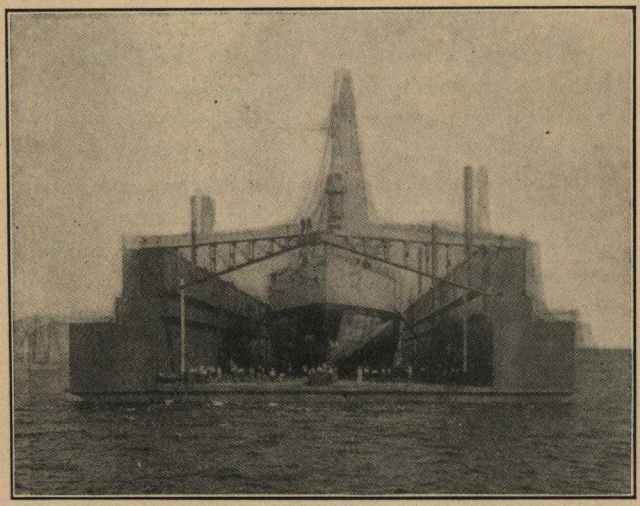
THE STORY OF
CUNNINGHAM PROTECTIVE PAINT.

Cunningham Protective Paint is the invention of a commissioned officer of the Navy, A. C. Cunningham, of the Corps of Civil Engineers. Mr. Cunningham originated this paint while stationed at the New Orleans Naval Station in 1901, in charge of the first large Government steel floating dry dock.

The Climate of New Orleans is especially severe on paints used on iron work on account of the intense heat of the summer and the constant great humidity. These conditions cause ordinary paints to "flour" rapidly and lose their protective qualities.

"Chalking" or "Flouring" is a term used by painters to indicate the condition of paint when the oil has completely oxidized, and lost its binding and elastic qualities, leaving the pigment in the form of dust.

The Idea of coal tar paint was suggested by the fact that the river craft in the New Orleans section use raw coal tar on their submerged portions, it being found that this resists the scour of the silt



DRY DOCK "DEWEY."
PAINTED WITH CUNNINGHAM PROTECTIVE PAINT.

carrying water better than any other coating that has been tried. It also was noted that a line of steamers plying between New Orleans and the West Indies made a practice of protecting the outer portions of their hulls above the water line with raw coal tar on account of its resistance to the immediate action of salt water and spray.

Raw Coal Tar has never found general favor as a protective coating for either metal or wood, owing to the fact that it never permanently sets or dries, and with rising temperature will run and assume a surface suggestive of alligator skin. A more important objection is that it contains unneutralized acids that are deleterious to both metal and wood. The action of these acids is slow and may become exhausted in time, but a scale will have formed under the tar that will expose the covered surface to the action of the water and air, and allow oxidation to proceed under the coating.

The Task assumed by Mr. Cunningham was to convert raw coal tar into a non-corrosive paint of high protective value and permanence, which would permanently set and dry. The problem involved chemical, mechanical and economical conditions, all to be reconciled in a practical result. Extensive experiments and numerous failures finally lead to a paint that filled the conditions of

permanently drying and possessing the required non-corrosive qualities.

The Successful Result of these first efforts has left a permanent mark. The exterior of the submerged pontoons of the steel floating dry dock at the New Orleans Naval Station is painted with this paint; after four years it appeared as bright and elastic as when first put on, and it was estimated that it would last at least three or four years longer before another coat would be required. The Government also required that the pontoon deck of the great steel floating dry dock Dewey should be painted with this paint when it was built. Upon the arrival of the Dewey at the Philippines, after a six months' trip half way around the world, the paint was found to have stood the trip so well that it was decided to continue its use permanently on the working pontoon deck. This deck is alternately wet and dry, and is subjected to great abrasion, and is frequently covered with various kinds of refuse. The best red lead paint had no durability on this deck, the foot travel alone wearing it off rapidly. The Government has also found it the best and most durable paint for the protection of a drydock caisson, which is exposed to the action of the tide, salt water, and abrasion from floating ice and debris. Still further

indications are that it is the only paint that will efficiently protect the interior of a floating dock for a reasonable time.

Saturated Salt Air in a hot climate is the most trying and severe condition to which paint can be subjected from natural causes. This is the prevailing condition at the Key West Naval Station, in addition to which many of the steel structures on the station are further exposed to salt spray during the severe storms that occur in that locality. Owing to these severe conditions, Key West was the place selected by the Bureau of Yards and Docks, Navy Department, to make the final test on the protective value and lasting qualities of structural paints. Tested at the Key West Station, in comparison with many high priced paints of the best quality on the market, the Cunningham Protective Paint has been pronounced the most durable and best suited to the severe conditions of the climate. It has been demonstrated by the Government at Key West that this paint can be successfully applied with paint spraying machines, and more important still, that it is the only paint so far tried that will unquestionably and permanently stick to galvanized iron, although some very expensive paints claim this quality.

The Most Significant Fact about this paint in its original form, is that the Isthmian Canal Com-

mission has painted over two thousand roofs with it in the canal zone, using over fifteen thousand gallons in one year. During the time of American occupation of the canal zone, approximately one million dollars had been used in labor and material in painting buildings for preservation, previous to the use of the Cunningham Protective Paint. It was found that unprotected galvanized iron has practically no life in that climate. Ordinary paints would hardly last one season, and the cost of preservation has been enormous. The Cunningham Protective Paint has very successfully solved the problem of paint protection on the Isthmus of Panama.

Many Other Facts of interest and importance could be cited to further show the great protective value of this paint, but enough has been given to show that Mr. Cunningham has invented a paint that greatly exceeds ordinary paints in protective value and durability.

The Materials which enter into the composition of this paint are of importance for the best protection and most durable results.

Coal Tar, which is the base of this paint, is a varying product both in composition and consistency. Gas Tars, of which there are great quantities on the market are not necessarily straight coal tar at all, but may be the result of the destructive

distillation of wood in the form of saw dust, leather refuse, or other carbonaceous matter mixed with bituminous coal, and from such tar it is found that reliable results cannot be obtained. The tar used in the Cunningham Protective Paint is that resulting from the manufacture of coke, thus securing very high quality and great uniformity, owing to the uniformity of the process and the great quantities of tar produced.

Other Ingredients entering into the Cunningham Protective Paint, as now manufactured by the Maryland Steel Co., are inorganic in their nature and are nothing used in ordinary paints. Their properties and proportions have received most careful study and investigation before offering the paint to the public.

Appearance: Highly ornamental results are not claimed for this paint as a first consideration, the great stress being placed on its high protective value and durability. It is always intensely black, however, and when first applied has a gloss which may later turn to a dead black if the surface is exposed to dust, smoke and grime. Unlike ordinary paint, in this respect, the turning to a dull black does not indicate a loss of life, but merely a tarnished surface. Decidedly handsome results may be had if the paint is carefully and intelligently ap-

plied on a smooth, clean surface, and then it resembles the highest grades of asphaltum paints and varnishes.

Preparation for Painting: No paint will stick to a surface that is not bare, clean and dry. In painting iron and steel surfaces, the most trouble comes from painting them too soon. There are two scales that form on iron and steel as it is rolled, both called "mill scale." The outer scale mostly drops off as the material cools and is handled. The second scale next to the material is thin, hard and tenacious, and may take from one to six months to separate from the material. When it begins to loosen it comes off in patches, some adhering much longer and more firmly than others, but it all comes off sooner or later, and if it has been painted over, the paint comes with it. The only way to remove this scale quickly from new material is by sand blast, or by "pickling" in dilute acid. The sand blast leaves bright metal which begins to rust at once and the pickling may leave acid on the material which will attack the metal, if it is not well washed or treated with lime. Both the sand blast and the pickling are expensive operations, and require special plants. Exposure for a sufficient length of time will quite as surely take off scale as the sand blast or pickling, and it is better and more economical practice if conditions and time permit.

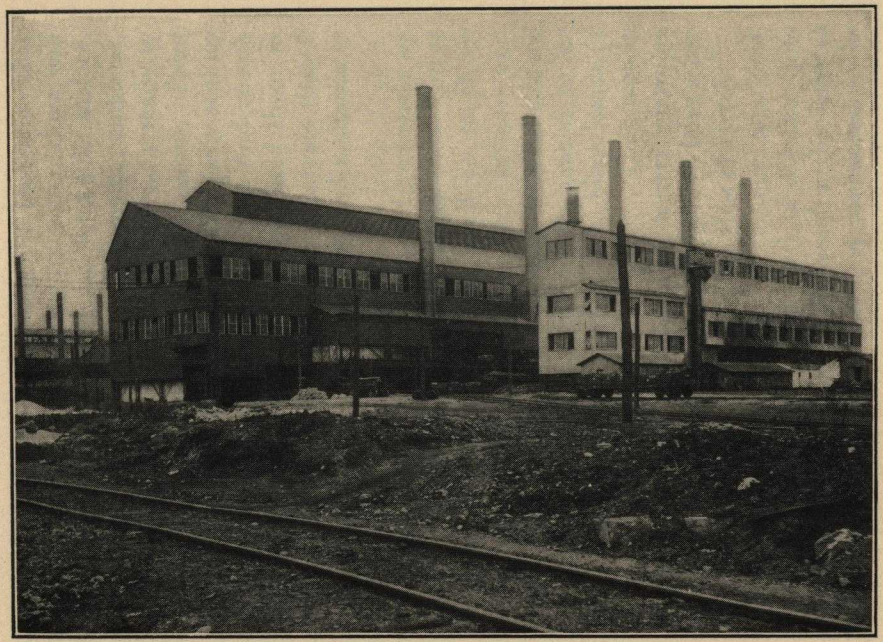
Rust is a great bug bear that structural engineers suffer from, and the fear of this natural enemy of iron and steel has directly given it one of its best chances to work havoc. To avoid unfavorable criticism, perhaps, as much as anything else, iron and steel are generally painted too soon, that is, before the scale has all come off. Later on the scale loosens, but is held in place by the paint, and a capillary surface is formed behind the scale next to the metal; air and moisture enter this pocket and the best possible condition is set up for rusting. If the paint is good and tenacious, the rusting continues until it is so thick that the paint is finally forced off, and generally the rust comes off with it. The surface which is left shows a dark oxide of iron and does not appear alarming to the ordinary observer. Red rust will again form and also eat in under the surrounding paint, until, finally, the entire surface is bare and the metal oxidizes rapidly. Frequently these conditions are blamed on the paint, which, if properly applied to a clean, bare, dry surface, would have protected the metal for a long time.

A Uniform Surface of thin, light yellow rust is the best preliminary condition that can be had for applying paint. It shows that the metal is free from scale and grease and in excellent condition to secure adhesion. So much of the rust as can be removed with a wire brush should be taken off and what is left need give no uneasiness.

There is a Tradition that if rust is once formed it will continue to eat into the metal, even if the surface is perfectly covered with paint. This myth arises from the action which takes place in the scale pockets which have been previously described. Iron exists in nature in the form of an oxide, and after refining, always tends to go back to oxide, but to do so must have oxygen; having secured its oxygen it will never give it up and return to metallic iron, which would be the case if rusting continued under a perfect protection of paint, where there can be no oxygen secured from the air.

Where rusting takes place freely on unprotected surfaces there is no transmission of oxygen from one part of the rust to a fresh metallic surface, but there is free access of air and moisture through the porous rust to the metallic surface beneath. As a proof of these statements we refer you to the well known "rust joint" that is made in important machinery with the strongly corrosive agent, sal-ammoniac. When a rust joint has been formed and the available oxygen has been exhausted, a joint like a weld has been formed, but we know from experience that nothing else happens as there is no further supply of oxygen available.

To Form Rust there must be present both air and water on the iron or steel surface, and a hot, moist atmosphere is the most favorable condition.



STEEL PLANT. PAINTED WITH CUNNINGHAM PROTECTIVE PAINT.

It is frequently demonstrated in the laboratory that perfectly dry air or perfectly pure water, alone, will not cause rust on a highly polished steel surface.

Rust Scale is a dangerous thing to paint over, and the thicker it is and the more nearly ready to separate from the iron, the more dangerous. Paint will not penetrate thick rust, but will partly seal up the outer surface. The spongy rust underneath will absorb air and moisture and hold them in contact with the metal for longer intervals than if there were no paint and the rust had a chance to dry out.

The Limit to the thickness of rust scale we believe to be about one-eighth of an inch, and at this point the rust begins to swell so much in volume that it separates from the surface and drops off. Sometimes the freshly exposed surface beneath is assumed by the inexperienced to be rolled surface, when it is, in fact, black oxide of iron in transmission to red oxide. Thus rusting continues, sometimes presenting a very alarming appearance followed by one that gives a false sense of security, but always with a wasting of metal.

The Chemical Action of sulphur, ammonia, and acid fumes on iron and steel is different from ordinary rusting, but the final result is the same as far as the wasting of the metal is concerned. The

action is more violent and rapid, and it is more difficult to protect metal from these active chemicals than from ordinary rusting. If you ever decide to try Cunningham Protective Paint, it will interest and enlighten you to test it in comparison with linseed oil paints of the highest price and quality by exposing the surfaces painted with each, to the action of fumes of acids and ammonia. The test is a violent one and unlike practical conditions, but it will give quick results and comparisons.

No Further Argument seems necessary to show that scales of original oxide or of subsequent rust are an absolute preventative to paint protection of iron or steel. It seems also to have been shown that a light coat of fresh rust that has not yet formed a scale is harmless. In this connection a not unusual English practice in connection with new ships is of interest; they frequently make a first trip between home ports without any paint whatever so that the salt water and spray may completely remove the mill scale and render the subsequent painting fully effective.

Grease, especially animal or mineral, even in a thin film, will prevent the adhesion of paint to metal. When metal has been so greased the best thing to do is to clean it with an alkali, if paint is to be applied.

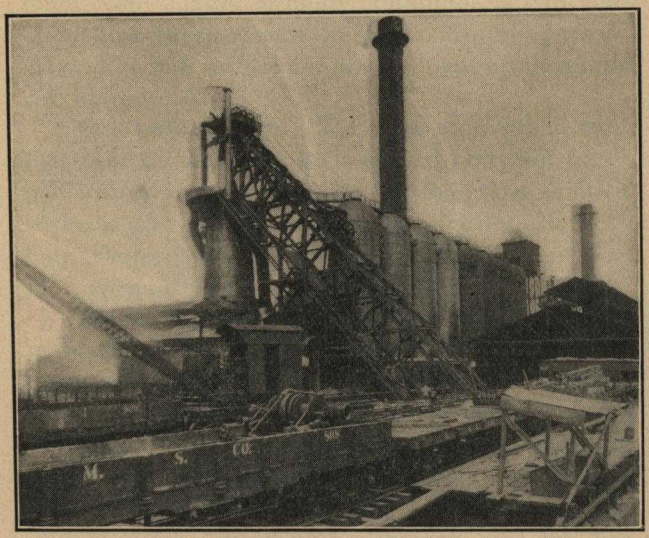
Moisture on metal is nearly as bad as grease, but more easily gotten rid of. If not removed, the film of moisture is imprisoned by the paint, contact with the metal is prevented, and the paint sets without adhesion, and in the course of time the paint skin comes away and leaves the metal bare. There are some extreme and unusual situations where metal cannot be kept dry for more than a few minutes and where the ordinary oil paint will wash off about as fast as applied. Under such conditions the metal may be chipped free from scale and cleaned with kerosene oil and then small patches dried with a painter's torch. This dried patch may then be covered with Cunningham Protective Paint, and if it secures an actual contact with the metal especially if the latter has become at all warmed, it will not all wash off. The application of successive coats of the paint then becomes easier. All this, however, is not an easy matter and requires patience and judgment.

Sufficient has been Said, perhaps, to give weight to the statement that surfaces should be clean, dry, and free from scale before paint is applied.

Wide Range of Applicability. Cunningham Protective Paint will firmly adhere to and durably protect any metal surface, bright, dull, smooth or

rough, while it is equally applicable to wood. For this, and other reasons, it is well adapted to a great diversity of uses, some of which are as follows:

Metal Roofs: Applied to old tin roofs, unless too far gone, the paint will preserve them indefinitely. The roof should be brushed clean with a stiff brush. If there are any large pin holes in the roof, the place may be first painted, and while the paint is fresh, coarse cotton cloth spread over it and stuck smooth and evenly to the paint; apply another coat of paint after the first is dry. Holes an inch in diameter can be stopped by placing a loose tin patch over them, sticking the patch down with cotton cloth and then painting over all. In painting new tin roofs, the tin should be painted on the underside before being laid, and two coats applied at the start, after which one coat on the exposed surface every three to five years will preserve the tin indefinitely. In this connection attention is particularly called to the fact that this paint will strongly adhere to and perfectly cover bright tin. It is a common practice to let tin roofs begin to show rust before ordinary paint is applied in order to insure its sticking to the tin; this practice simply means that the value of the tin coating on the iron is destroyed and its original purpose defeated.



BLAST FURNACE.
PAINTED WITH CUNNINGHAM PROTECTIVE PAINT.

Smoke Stacks and Boiler Fronts. This paint has proven to be a very serviceable one for this class of work. It imparts a neat appearance, and at the same time affords protection, at a minimum cost. Under ordinary conditions, it will give about five years service on stacks, if applied properly. On hot surfaces, more frequent applications will be required.

Galvanized Iron. We know of no other paint that will permanently stick to and perfectly cover galvanized iron. It is one of the most difficult surfaces that exists to make paint stick on; Cunningham Protective Paint, however, adheres to it like glue, without previous preparation.

Water Tanks and Receptacles. Ordinary paints are not adapted for use on the interior of tanks or vessels for holding water, as the metallic substances which they contain are liable to form poisonous compounds. Cunningham Protective Paint is fundamentally different from these; it contains no metallic substance, nor any ingredient soluble in water. Its chief constituent, coal tar, has antiseptic properties, which make it a valuable interior coating for water vessels of wood or metal. This has been thoroughly tested and demonstrated in tanks and pails used for drinking water; the paint not only protects and preserves the interior of the

receptacle, but tends to keep the contents sweet and fresh, while imparting neither taste nor odor.

Silos. Many difficulties have been encountered in obtaining a satisfactory and economical coating for the interior of silos,—a coating which will render them air and water tight, and which at the same time is neutral and non-injurious, and is not acted upon by the liquor from the ensilage. Cunningham Protective Paint meets these requirements in every particular, and is being used most successfully for this purpose.

Use on Concrete. Applied to concrete, Cunningham Protective Paint makes a most efficient waterproof coating, sealing up the pores, and forming a surface which is impervious to moisture, frost or water. Extensive tests have been made, using hollow forms constructed of lean porous concrete; before coating, these forms were very permeable, water passing through them freely under the slightest pressure. Two coats of Cunningham Protective Paint rendered them water tight, even when exposed to pressures of 20 to 30 lbs. to the square inch, (equivalent to water heads of 45 to 70 feet.) In actual practice this paint has proven thoroughly efficient on underground conduits, concrete roofs subject to vibration, etc., where difficulty had been experienced with water seepage. When used

on concrete, the paint should be applied to the water side; i. e., the surface which will be exposed to water or dampness. Care should be taken that the concrete is thoroughly dry before painting.

Marine Work. This paint has proven most satisfactory on the side and deck plates of steamships, showing remarkable resisting power to the action of salt water and spray. It has also been used successfully to protect the bottoms of wooden barges on the coast of Florida, against the teredo, or shipworm; in one instance a single coat was found sufficient to afford protection for an entire season.

Wood. Cunningham Protective Paint is a most excellent protector of wood surfaces where the color is not of importance. It closes the pores and prevents water-soaking. Applied to wood carefully in a few thin coats, it produces an effect like lacquer.

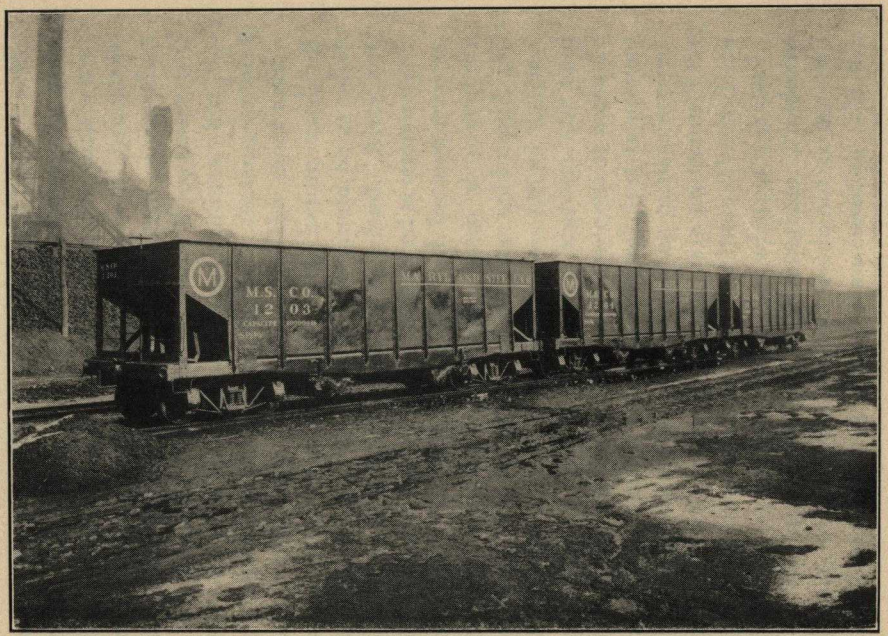
Sidewalks and Fences. As an economical paint for wood sidewalks and fences, this paint is unsurpassed. We cite the following as an illustration: a boardwalk, 3,600 feet long, was treated by painting the stringers one coat, and dipping the cross planks, at a total cost of about one-half cent per square foot for material and labor.

Brick Walls. Exposed walls of brick that have been constantly damp from driving rains, have been made dry and water proof by the application of this paint.

Wearing Surfaces. A very durable, and at the same time, protective surface can be made on metal that has to be walked on by first painting with this paint and before it is dry, sprinkling the surface with sand. After it is dry the process can be repeated to form a thicker surface.

Use with White or Colored Paints. In our original booklet, we warned against placing ordinary oil paints over the Cunningham Protective Paint on account of the discoloration of the oil paint that would follow. Since then we have found that by coating the paint after it is dry with shellac, white or colored oil paint can be applied on the shellac without any discoloration whatever following. This is of great importance and value, as it permits of lettering and numbers being placed on the paint for steel cars, etc., or any finishing color of oil paint that may be desired. The shellac that we use for this purpose is composed of one quart of liquid shellac; one quart denatured alcohol; and two ounces of lamplack, and costs from $1.00 to $1.25 per gallon. A gallon will cover about 900 square feet of the paint, so it will be seen that the expense of preparing the paint to receive other colors of oil paint is small; when the entire surface is to be painted, the lampblack may be omitted from the mixture.

Consistency and Weather Conditions. This paint differs from linseed oil paints in consistency



STEEL CARS, PAINTED WITH CUNNINGHAM PROTECTIVE PAINT.

and nature, and has a tendency to "pull" on the brush as compared with them. Consequently, there is a tendency to put the paint on thicker than is necessary; this, while it does not lessen its protective value, is liable to impair the appearance by producing a mottled or "alligatored" effect. This property is not marked at ordinary temperatures, but becomes apparent at about 40° F. At temperatures below this it is advisable to warm the paint until it reaches the proper consistency, before applying. High heating is detrimental and should be avoided; at 70° to 80° F., the paint is very fluid. Metal surfaces however, should not be painted at temperatures below 40° F., if it can be avoided, for two reasons. In the first place, the paint, even if previously warmed, will, on contact with the cold metal, immediately chill, stiffen, and fail to spread satisfactorily. The second reason is, that on any cold metal surface, there is a certain amount of moisture deposited,—often invisible, but sufficient to prevent proper contact and adhesion when paint is applied. Subsequently a rust scale will form underneath the paint, causing it to peel off later on. This will be found to be the case, no matter what paint is used.

Drying Qualities. Cunningham Protective Paint is not a rapid drier, and we do not recommend its use where quick drying is an essential. On the

other hand, where the nature of the work will permit, moderately slow drying is a desirable quality, as it indicates permanent adhesion and durability. Painters generally admit that quick drying is not conducive to long service. The majority of quick-drying paints set too rapidly to properly penetrate the pores of the surface to which they are applied; in drying they also contract quickly, which tends to tear the coat loose in spots, causing it to blister, crack and peel. Other quick-drying paints become very brittle, and chip or scale off very easily. These troubles are never experienced with Cunningham Protective Paint; it dries slowly but adheres most tenaciously, forming an elastic coating which is permanent. Its time of drying depends somewhat on the method of application, and upon weather conditions, but at least 24 hours must be allowed for each coat to set, and somewhat longer for complete drying, especially in cold weather.

Thinning. For the general run of work our standard mixture is entirely suited. Where special fluidity is desired, however, we recommend the use of "Cunningham Thinner." This is a solvent compound especially prepared and particularly adapted for the thinning of this paint, which we are prepared to furnish at a nominal cost. Excessive thinning should be avoided, as it lessens the covering and

protective value of the paint. Turpentine, or other oils ordinarily used for thinning paint will not prove satisfactory. In any case, where the nature of the work calls for special thinning of the paint, we will gladly advise, and furnish detailed instructions regarding it.

Weight. The specific gravity of Cunningham Paint, after being thoroughly stirred, is about 1.17, or weight per gallon, 9.75 lbs.

Covering Capacity. The best method for testing the covering capacity of a paint is by application with a brush; it should be fluid enough to spread without being sticky, but at the same time should have enough body to leave a thorough coat behind a moist brush. A comparative test with metallic brown in linseed oil, and Cunningham Protective Paint resulted as follows:

1 gal. of metallic brown - - covered 1212 sq. ft.
1 " " Cunningham Protective Paint " 1256 " "

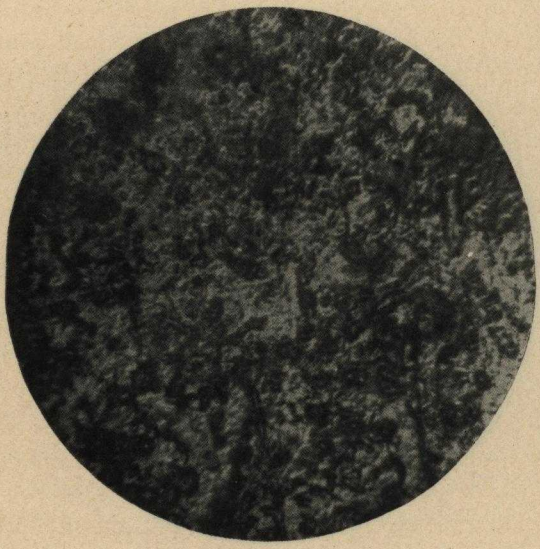
The difference in fluidity and spreading power was apparent, and readily detected; these figures, however, are much higher than could be attained in actual work. For the best results we recommend the use of one gallon of Cunningham Protective Paint for every 500 square feet of surface for each coat.

In a spraying test, 1,000 square feet of sheet

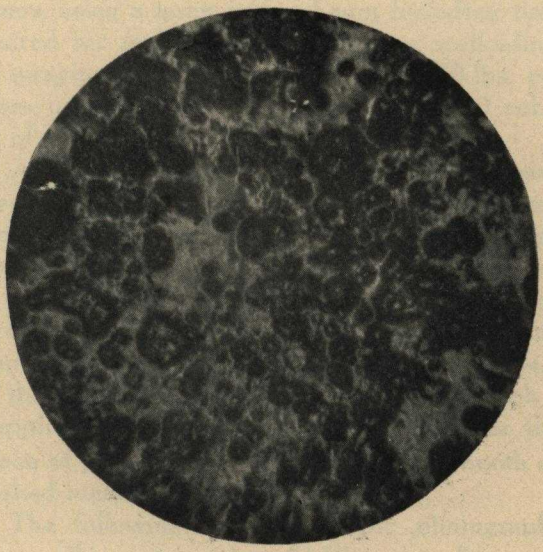
metal were painted by one painter and helper, in 15½ minutes, 1.8 gallons of paint being used. A sheet metal tank having a surface area of 3,200 square feet was painted by one painter and two helpers, using a spray, in five hours, including time required for putting up and changing scaffolding. For spraying, an air pressure of 75 to 100 lbs. per square inch is required, at which 15 to 20 cubic feet of air will be used per minute.

A conclusive test to demonstrate the adhesive power and covering property of paint is to spread it on glass and observe it with a microscope. This does not absolutely demonstrate the durability of the paint proper, but does demonstrate that the more metal left exposed by paint, the more extensive will be corrosive action, and the quicker will the paint be thrown off the surface to which it is applied. The test is a practical one, as the surface of glass resembles the surface of smooth or polished metal.

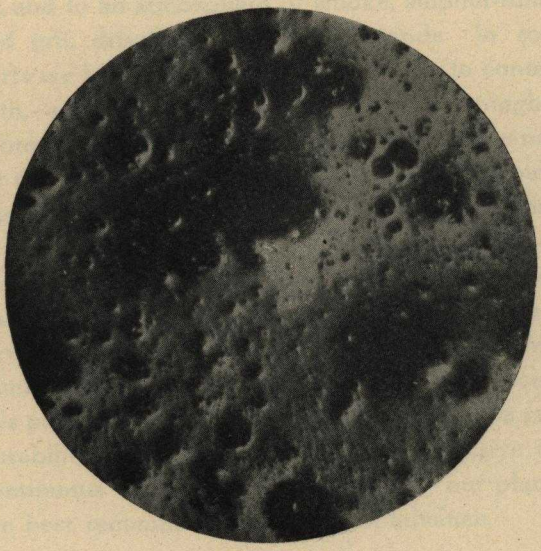
The following are microscopic photographs of an oil paint costing $1.50 per gallon and Cunningham paint applied to glass. The dark portions represent uncovered glass, the photographs being made by light transmitted through the glass. The magnification in these photographs is fifty diameters.



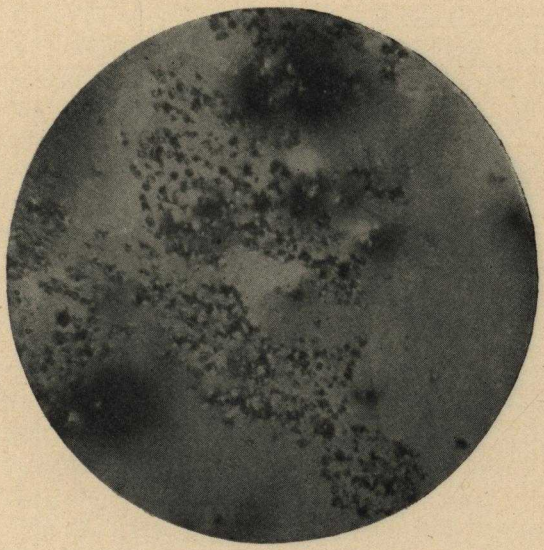
One coat of an Oil Paint costing $1.50 per gallon on glass.
Covering poor.



Two coats of the same paint on glass. First coat extensively and badly disturbed, and covering very poor.



One coat of Cunningham Protective Paint on glass.



Two coats of Cunningham Protective Paint on glass. Covering nearly perfect, and none of first coat disturbed.

Our Own Experience. The paint problem has been a serious one with us in the past. The buildings comprising our plant are exposed to damp air, and to an atmosphere of smoke, sulphur-fumes, and grit, driven about by high winds. In some parts we have ammonia and acid fumes to contend with,—rust and corrosion everywhere. Cunningham Protective Paint has proven a most efficient remedy for these troubles. Used first on our older buildings, its durability and protective qualities have been so marked, that no other paint has been considered for later structures. Our open-hearth building, completed some years ago, as well as a new blast furnace recently built, were painted with Cunningham Protective Paint. The low price of this paint is of less importance to us than its great durability and protective value. Its extensive and continuous use in all departments of our plant is the best recommendation we can advance.

Other Coal Tar Paints. Our success with this paint is leading others to place coal tar paint on the market. The Cunningham Protective Paint is the result of ten years of study, experiment and test, and it has been refined and perfected by

us in the laboratory and adapted to meet all conditions. We made it first for our own use and not until we had made it as good a protector as could be found did we place it on the market.

Public Protection, as well as our own, has led to the adoption of a distinctive trade mark for this paint, with the consent of the inventor, and this trade mark will be found on all packages put up by the Maryland Steel Co.

Cunningham Protective Paint is put up in 1, 2, 5 and 10 gallon cans, half-barrels and barrels. Price, or any special information desired, gladly furnished.

MARYLAND STEEL CO.
PAINT DEPT.
SPARROW'S POINT, MD.

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